

SYNOPSIS OF PANURGIDÆ (HYMENOPTERA).

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My synopses of local bees are intended to show how I distinguish them. It is assumed that the student has only the local species and all of them. Nothing follows from such a statement as that *Chloralictus nymphalis* runs to *C. testaceus* in my table of Halictinæ. If it had been one of the local species, it would not have run to that name.

The differences between the Panurgidæ and Dufoureidæ are partly mentioned in the "Synopsis of Anthophila", Can. Ent. 36: 42, 1904. The local species mix the pollen with honey, but *Panurgus* evidently does not. It has a large scopula which is not necessary in those which stick the pollen with honey.

Often the two cubital cells are not homologous, so that the bees are referred here on account of other resemblances. In Perditinæ the cubital cells are the first and third, the second being obliterated by coalescence of the first and second transverse cubital nervures. The "first transverse cubital" is a compound vein, and the "second" is really the third. Usually in the rest of the Panurgidæ the true second transverse cubital vein is wanting and the one called "second" is the third. The "second cubital cell" is composed of the second and the third united. I have a specimen of *Pseudopanurgus compositarum* with three cubital cells. In true *Panurginus* I think the first and second cubital cells are united and that the venation is not homologous with that of American species which have been referred to that genus. I have seen *P. albopilosus* and *montanus*, determined by Friese. These have an independent origin from forms having three cubital cells.

Abbreviations.—1p 1 = basal joint of labial palp; 1p 4:2 = length of first and second joints as 4 to 2; Ma, Mas = long-tongued bee flowers; Mi, Mis = short-tongued bee flowers; mp 6 = maxillary palps six-jointed; oligolege = bee collecting pollen

from related flowers; Pol = polytropic flowers, adapted to various short-tongued insects; R = Red, all dark colors; social flowers = flowers crowded so that insects pass from one to another without taking wing or climbing; W = white; Y = yellow, greenish to orange,

Females.

1. Marginal cell about as long as stigma; cubital cell 1 about twice as long as 2; recurrent veins about opposite transverse cubitals; discoidal part of basal vein about twice as long as cubital part; lower border of discoidal cell 3 shorter than that of 1; middle spur about half as long as planta; face with colored marks; scopa simple, pollen on front of tibia; glossa linear; 1p 1 flat, longer than 2-4; head and thorax greenish, abdomen black or brown, **Perditinae.**
 2. Marginal cell longer than stigma; cubital cells usually subequal; recurrent vein 1 beyond transverse cubital 1, 2 usually before 2; discoidal part of basal vein more than twice as long as cubital part; middle spur more than half as long as planta; mp 6; black, 3.
 3. Stigma middle-sized; recurrent veins about equally distant from transverse cubitals; face with yellowish marks; scopa simple, pollen mainly on front of tibia but also around planta; glossa filiform; 1p 1 flat, at least longer than 2-4, **Calliopsinae.**
 - a. Stigma large; recurrent vein 1 usually remote from transverse cubital 1, 2 near or opposite 2; lower border of discoidal cell 3 shorter than that of 1; face without marks; pollen on front of tibia, **Anthemurginae.**

Males.

4. Venation as in 1 Perditinae.
Venation as in 2, mp 6 5.
5. Venation as in 3, Calliopsinae.
Venation as in 3a Anthemurginae.

*PERDITINAE**Females.*

Claws simple; clypeus, interrupted basal fasciae on segments 2-3, wings and veins, whitish; border of stigma and of marginal cell fuscous; mp 6, short; 1p 5: 1; 4mm; oligolege of *Boltonia asteroides*; Sept. 3; *boltoniae* in, **Perditella.**

Claws with an inner tooth,

1.

1. Veins fuscous; claw tooth subapical; five marks on face, base of mandibles, two spots on collar, tubercles, anterior tibiae in front, middle knees, and oblique basal fasciae on sides of segments 1-4, whitish; mp 6, long; 1p 6: 1; 6-7mm; oligolege of *Astereæ* and *Heliantheæ*; Aug. 17-Sept. 20; *octomaculata* in **Perdita.**

Veins black; claw tooth median; mandibles, anterior tibiae in front, and tarsi, yellowish; usually a dot on each side of segment 3, and often on 4; middle tibiae more or less yellowish; mesonotum purplish; metathorax bluish; mp short, joints indistinct; 1p 9: 2; 5-7mm; oligolege of *Physalis*; July 7-Sept. 3; *maura* in, **Zaperdita.**

Males.

Cheek with a distinct process; subdisoidal and recurrent vein 2 obsolete; mandibles, clypeus, anterior tibiae in front, middle knees and tarsi, whitish; 4-5mm; Aug. 30-Sept. 8; *boltoniae* in, **Perditella.**

Cheek simple; veins ordinary; at least the mandibles, labrum, clypeus, sides of face, scape, flagellum beneath, anterior and middle tibiae in front, front and middle tarsi, and hind knees, yellow

1.

1. Face of about equal width below; cheeks narrow; coxae trochanters, anterior and middle femora and tibiae in front, and spots on segments 1-4, yellow; hind tarsi dark; 5-6mm; Aug. 13-Sept. 24; *octomaculata* in, **Perdita.**

Face broader below; cheeks broad; coxae, trochanters, femora except tips, and abdomen, black; front and middle tibiae almost entirely yellow; posterior orbits yellow below; hind tarsi yellow; 5mm; July 17-Aug. 1; *maura* in, **Zaperdita.**

CALLIOPSINÆ

Females.

Front tarsi simple; disc of metathorax short, rugose; abdomen finely punctured, rather opaque; veins dark; cubital cell 2 narrowed about one-half above; ornaments luteous, at least the clypeus in part, spot above, sides of face, two lines on collar, and front and middle knees; flagellum testaceous beneath; 1p 7: 1,

Calliopsis.

Front tarsi with curled spines; disc of metathorax smooth, shining, foveate; abdomen sparsely punctured, shining; wings hyaline, veins pale; cubital cell 2 narrowed less than one-half above; apex of labrum and of clypeus, triangular mark on each side of face, base of mandibles, and front knees, whitish; mp and galea 5: 14; 1p 13: 1; 7-8mm; oligolege of *Verbena*; June 28-Sept. 10; *verbena* in

Verbenapsis.

Males.

Disc of metathorax shining, foveate; wings hyaline, veins pale; cubital cell 2 narrowed less than one-half above; front tarsi pale, with long hair; base of mandibles, middle of labrum, sides of face, clypeus except sides of base, front and middle knees, and line on front tibia, whitish; 6-7mm; July 2-Sept. 1; *verbena* in,

Verbenapsis.

Disc of metathorax opaque, rugose; wings a little dusky, veins dark; cubital cell 2 narrowed about one-half above; front tarsi with short hair; at least the mandibles, labrum, face below antennæ, two lines on collar, tarsi, and tibiæ in front, yellow,

Calliopsis.

*CALLIOPSIS**Females.*

Clypeus black, with a median stripe, 3 spots above; lateral face marks subquadrate, not extending above antennæ; spot on tubercles; rarely a dot on tegulæ; labrum dark; mp and galea subequal; 6-8mm; polylege; May 30-Oct. 14, **andreniformis.**

Clypeus luteous, with two black stripes, 1 spot above; lateral face marks pointed above antennæ; tubercles black; dot on tegulæ; mp shorter than galea; 7mm; oligolege of *Heliantheæ* and *Astereæ*; Aug. 20-Sept. 19, **coloradensis.**

Males.

Tubercles, legs, antennæ except flagellum at base above, yellow; tegulæ usually dark; 5-6mm; May 30-Sept. 19
andreniformis.

Tubercles, coxae, trochanters, femora except tips, tibiæ behind, and apical joints of tarsi more or less, black; dot on tegulæ; line on scape in front; flagellum testaceous beneath; 6-7mm; Aug. 21—Sept. 24, **coloradensis.**

*ANTHEMURGINÆ.**Females.*

Scopa plumose; glossa linear, acuminate; 1p 1 elongate, flat; mp not longer than galea; tegulæ and front and middle knees testaceous, **Pseudopanurgus.**

Scopa simple; mp longer than galea,

1.

1. Lp 4: 1½, 1 flat; glossa lance-linear, acuminate; nearly bare, finely and densely punctured, opaque; middle spur sparsely peeltinate, about as long as planta; tegulæ and front and middle knees testaceous; 5-6mm; polylege; May 28—Oct. 23; *parvus* in, **Heterosarus.**

Lp 2:2, 1 simple, incrassate; glossa lanceolate, shorter than mentum; middle spur finely pectinate, two-thirds as long as planta; finely punctured, shining, head more coarsely punctured and opaque; knees black; apical half of wings clouded; 7-8mm; oligolege of *Passiflora lutea*; July 21—Sept. 9; *passiflora* in **Anthemurgus.**

Males.

Clypeus and sides of face with yellow stripes; black, mandibles, tarsi, anterior tibiæ in front, and sometimes middle ones, testaceous; apical half of wings clouded; 7-8mm; July 21—Aug. 30; *passiflora* in **Anthemurgus.**

Clypeus entirely and sides of face yellowish or whitish, 1.

1. Lateral face marks hardly extending above clypeus; mandibles, middle of labrum, clypeus and face marks, whitish; flagellum beneath, tubercles, tegulae, knees, tarsi, and anterior tibiæ in front, testaceous; 5-6mm; May 28—June 15; *parvus* in **Heterosarus.**

Lateral face marks extending above clypeus; at least the clypeus, sides of face, tarsi, anterior tibiæ in front, and bases of middle and hind tibiæ, yellow, **Pseudopanurgus.**

PSEUDOPANURGUS

Females.

Mesonotum rugose, with coarse confluent punctures; enclosure of labrum subquadrate; a supraorbital tubercle; wings clouded beyond middle; recurrent vein 1 remote from transverse cubital 1, 2 near transverse cubital 2; mp shorter than galea; 1p 10: 2; 7-8mm; oligolege of *Heliantheæ*; Aug. 2—Oct. 1, **rugosus.**

Mesonotum more finely punctured, 1.

1. Enclosure of labrum subquadrate, 3.

Enclosure of labrum rugose, strongly narrowed apically; middle of flagellum beneath testaceous; mp a little shorter than galea, 2.

2. Metathorax shining, impunctate; tubercles yellow; head and mesonotum more sparsely punctured; veins darker; 1p 7: 2; 6-7mm; oligolege of *Heliantheæ*; Aug. 3—Sept. 28, **labrosus.**
Metathorax opaque, punctate behind; tubercles dark; head and mesonotum more closely and coarsely punctured; veins paler; 1p 6½: 3; 5-6mm; oligolege of *Heliantheæ*; Aug. 15—Sept. 25 **labrosiformis.**
3. Hind tarsi not yellow; 6-7mm, 5.
Hind tarsi yellow; mp shorter than galea 4.
4. Scutell shining, almost impunctate; mesonotum not trisulcate; enclosure of labrum more narrowed apically; wing clear hyaline; veins pale; scopa with long, long-barbed hairs; 1p 8: 3; 6-7mm; oligolege of *Heliantheæ*; May 29—Sept. 5, **albitarsis.**
Scutell more opaque, closely punctured; mesonotum trisulcate; enclosure of labrum less narrowed apically; wing less hyaline; scopa with short, short-barbed hairs; 1p 7: 3; 5-7mm; oligolege of *Astereæ* and *Heliantheæ*; Aug. 11—Oct. 4, **solidaginis.**
5. Mesonotum nearly bare; shining, rather finely and closely punctured; scopa rather short; mp about equaling galea; 1p 4: 1; oligolege of *Astereæ* and *Heliantheæ*; Aug. 23—Oct. 23, **asteris.**
Mesonotum distinctly pubescent, 6.
6. Mesonotum entirely pubescent, opaque, with large shallow dense punctures; scopa rather short; mp about equaling galea; 1p 4: 1½; oligolege of *Astereæ*; Sept. 6—Oct. 29, **compositarum.**
Mesonotum pubescent in front, shining, minutely and sparsely punctured; scopa long and thin; mp a little shorter than galea; 1p 4½: 2; oligolege of *Heliantheæ*; Aug. 1—Sept. 12, **rudbeckiae.**

Males.

- Mandibles and labrum yellow. 2.
 Mandibles and labrum black; apical joints of tarsi blackish; 6-7mm 1.
 1. Mesonotum coarsely reticulated; wings clouded beyond middle; broad bases of middle and hind tibiæ yellow; July 29—Aug. 22, ***rugosus.***
 Mesonotum shining, sparsely punctured; wings hyaline; middle and hind knees yellow; June 11—Sept. 8, ***albitarsis.***
 2. Enclosure of labrum slightly narrowed towards apex, 4.
 Enclosure of labrum strongly narrowed and subbidentate at apex; middle joints of flagellum fulvous beneath, 3.
 3. Metathorax shining, impunctate; tubercles yellow; hind tibiæ broadly yellow at base; 5-6mm; Aug. 1-30 ***labrosus.***
 Metathorax punctured behind; tubercles black; hind knees yellow; 4-5mm; Aug. 3—Sept. 8, ***labrosiformis.***
 4. Middle of clypeus concave, impunctate; tubercles and middle and hind knees yellow; 5-7mm; Aug. 3—Sept. 7, ***rudbeckiae.***
 Middle of clypeus convex, punctate, 5.
 5. Mesonotum opaque, with large dense shallow punctures, closely pubescent; antennæ long; face below antennæ, and tibiæ, except spot beneath, yellow; 5-6mm; Aug—28—Oct. 4, ***compositarum.***
 Mesonotum more shining, the pubescence short or sparse, 6.
 6. Hind tibiæ yellow at least on basal third; tubercles yellow; mesonotum finely punctured, not trisulcate; 5-6mm; Aug. 23—Oct. 21, ***asteris.***
 Hind tibiæ yellow at extreme base; tubercles black; mesonotum coarsely punctured, trisulcate; 4-6mm; Aug. 12—Sept. 7, ***solidaginis.***

PHENOLOGY.—Of the dominant families of bees the Panurgidæ have the most definite phenological position. They fly from May 28 to October 29, all of them together August 30—September 3.

Phenologically the sexes begin and end as follows:

Begin			End		
σ first	σ ♀ together	♀ first	♀ last	σ ♀ together	σ last
37.5	25.0	37.5	75.0	....	25.0

The males which are first precede by 6.1 days and the females which are last are later by 29.2 days. It is probable that all of the species are proterandrous, but the males precede by so few days and are so much harder to observe that it is not easy to prove the proterandry. My dates give the earliest ever observed and it is probable that, in the year in which the earliest date for the female was recorded, the male really preceded. The records show 124 flower visits for the females and 92 for the males, which indicates how much more likely the flight of the female is to be correctly made out.

Taking the cases in which the males were first and the females last as normal examples we have for the average number of days:

	σ precedes	♀ follows	σ	♀	Species
4 normal	7.2	27.5	32.5	52.7	59.5
12 others	....	....	46.0	66.3	68.6
Total	....	....	42.6	62.9	66.3

The oligoleges are 85.5 per cent. of the species. They average 55.3 days, while the two polyleges average 143.5 days.

FLOWER VISITS.—In the following lists the pollen visits of the female (σ e) are separated from the nectar visits (σ s). The pollen visits do not exclude nectar visits to the same flowers. Visits of the male (σ s) not made by the female also are in italics. Visits to Compositæ are distributed under Anthemideæ, Astereæ, Eupatoricæ, and Heliantheæ.

ANTHEMURGUS PASSIFLORÆ.—♀ c (1): *Passifloraceæ*: Passiflora, type July 31.

♂ s (1): *Passifloraceæ*: Passiflora lutea, type July 31.

CALLIOPSIS ANDRENIFORMIS (51).—♀ c (19): *Astereæ*: Aster ericoides villosus; *Heliantheæ*: Verbesina helianthoides; *Labiatae*: Lyeopus sinuatus, Pyrenanthemum pilosum; *Leguminosæ*: Desmodium marilandicum, D. paniculatum, Melilotus alba, Psoralea onobrychis, Trifolium repens, T. pratense; *Lythraceaæ*: Lythrum alatum; *Malvaceæ*: Malva rotundifolia; *Oxalidaceaæ*: Oxalis stricta; *Polygalaceaæ*: Polygala sanguinea; *Rubiaceaæ*: Houstonia purpurea; *Scrophulariaceaæ*: Gerardia tenuifolia; *Verbenaceaæ*: Lippia lanceolata, Verbena hastata, V. urticifolia.

♀ s (23): *Acanthaceaæ*: Dianthera americana; *Heliantheæ*: Bidens aristosa, Coreopsis palmata; *Labiatae*: Blephilia ciliata, Hedeoma pulegioides, Nepeta cataria, Prunella vulgaris, Pyrenanthemum flexuosum, P. virginianum; *Leguminosæ*: Amorpha canescens, Lespedeza procumbens, L. reticulata, Strophostyles pauciflora, Stylosanthes biflora, Trifolium hybridum; *Lythraceaæ*: Ammannia coccinea; *Orchidaceaæ*: Spiranthes gracilis; *Polygonaceaæ*: Polygonum pensylvanicum; *Portulacaceaæ*: Portulaca oleracea; *Scrophulariaceaæ*: Ilysanthes riparia; *Umbelliferae*: Eryngium yuccæfolium; *Verbenaceaæ*: Verbena bracteosa, V. stricta.

♂ s (29:9): *Acanthaceaæ*: Dianthera americana; *Anthemideæ*: Chrysanthemum leucanthemum; *Heliantheæ*: Coreopsis palmata, Rudbeckia triloba; *Labiatae*: Blephilia ciliata, Hedeoma pulegioides, Pyrenanthemum pilosum, P. virginianum, Stachys palustris; *Leguminosæ*: Lespedeza capitata, L. procumbens, L. reticulata, Melilotus alba, Psoralea onobrychis, Trifolium hybridum, T. repens; *Malvaceaæ*: Malva rotundifolia; *Polygonaceaæ*: Polygonum pensylvanicum; *Polygalaceaæ*: Polygala sanguinea; *Rhamnaceaæ*: Ceanothus americanus; *Rosaceaæ*: Geum album, Gillenia stipulacea, Potentilla monspeliensis; *Rubiaceaæ*: Houstonia purpurea; *Scrophulariaceaæ*: Gerardia tenuifolia; *Umbelliferae*: Cryptotaenia canadensis, Eryngium yuccæfolium; *Verbenaceaæ*: Lippia lanceolata, Verbena urticifolia.

♂ ♀ in copula (1): *Psoralea onobrychis*, June 26; several other cases not recorded.

CALLIOPSIS COLORADENSIS (5).—♀ c (5): *Astereæ*: *Boltonia asteroides*, *Solidago canadensis*; *Heliantheæ*: *Bidens aristosa*, *Coreopsis tripteris*, *Rudbeckia triloba*.

♂ s (4) *Astereæ*: *Boltonia asteroides*, *Solidago canadensis*; *Heliantheæ*: *Bidens aristosa*, *Rudbeckia triloba*.

♂ ♀ in copula (7): *Bidens aristosa*, Aug. 31; *Boltonia asteroides*, Aug. 29, Sept. 1; 12, two pairs; *Solidago canadensis*, Aug. 23, Sept. 12.

HETEROSARUS PARVUS (8).—♀ c (7): *Astereæ*: *Aster ericoides villosus*, *Solidago canadensis*, *S. ulmifolia*; *Geraniaceæ*: *Geranium carolinianum*; *Labiatae*: *Monarda bradburiana*, type May 28; *Rosaceaæ*: *Gillenia stipulacea*; *Umbelliferæ*: *Eulophus americanus*.

♀ s (1): *Umbelliferæ*: *Thaspium aureum trifoliatum*.

♂ s (1): *Rosaceaæ*: *Gillenia stipulacea*.

PERDITA OCTOMACULATA (7).—♀ c (5): *Astereæ*: *Aster ericoides villosus*, *Boltonia asteroides*, *Solidago canadensis*, *S. ulmifolia*; *Heliantheæ*: *Bidens aristosa*.

♀ s (1): *Labiatae*: *Lycopus sinuatus*.

♂ s (5:1): *Astereæ*: *Boltonia asteroides*, *Solidago canadensis*; *Eupatorieæ*: *Eupatorium altissimum*; *Heliantheæ*: *Bidens aristosa*; *Labiatae*: *Lycopus sinuatus*.

♂ ♀ in copula (3): *Bidens aristosa*, Sept. 4; *Lycopus sinuatus*, Sept. 5; *Solidago canadensis*, Aug. 17.

PERDITELLA BOLTONIÆ (1).—♀ c (1): *Astereæ*: *Boltonia asteroides*, type Sept. 3.

♂ s (1): *Astereæ*: *Boltonia asteroides*, type Sept. 3.

PSEUDOPANURGUS ALBITARSIS (11).—♀ c (8); *Heliantheæ*: *Brauneria pallida*, *B. purpurea*, *Helianthus divaricatus*, *H. mollis*, *Rudbeckia hirta*, *R. laciniata*, *R. subtomentosa*, *Verbesina helianthoides*.

♀ s (2): *Heliantheæ*: *Coreopsis palmata*, *Lepachys pinnata*.

♂ s (8:1) : *Astereæ*: *Aster ericoides villosus*; *Heliantheæ*: *Brauneria pallida*, *Coreopsis palmata*, *Helianthus divaricatus*, *H. mollis*, *Rudbeckia hirta*, *R. laciniata*, *Verbesina helianthoides*.

♂ ♀ in copula (5) : *Helianthus mollis*, Aug. 23; *Rudbeckia hirta*, June 18: 23, two pairs; 26.

PSEUDOPANURGUS ASTERIS (8).—♀ c (8): *Astereæ*: *Aster ericoides villosus*, *A. lateriflorus*, *A. sagittifolius*, *Solidago canadensis*, *S. nemoralis*, *S. serotina*, *S. ulmifolia*; *Heliantheæ*: *Rudbeckia triloba*.

♂ s (4): *Astereæ*: *Aster ericoides villosus*, *A. sagittifolius*, *Solidago canadensis*, *S. ulmifolia*.

♂ ♀ in copula (5): *Aster ericoides villosus*, Sept. 14, 1893, *type*: Sept. 14, 1896; 20; *A. sagittifolius*, Aug. 30; *Solidago canadensis*, Sept. 1.

PSEUDOPANURGUS COMPOSITARUM (12).—♀ c (7)

Astereæ: *Aster ericoides villosus*, *A. lateriflorus*, *A. multiflorus*, *A. novæ anglæ*, *A. paniculatus*, *Boltonia asteroides*, *type* Sept. 20, *Solidago ulmifolia*.

♀ s (3): *Astereæ*: *Aster salicifolius*, *Solidago nemoralis*; *Polygonaceæ*: *Polygonum dumetorum*.

♂ s (6:2): *Astereæ*: *Aster ericoides villosus*, *A. lateriflorus*, *Boltonia asteroides*, *type* Aug. 28; *Heliantheæ*; *Bidens aristosa*, *Rudbeckia triloba*; *Polygonaceæ*: *Polygonum dumetorum*.

PSEUDOPANURGUS LABROSIFORMIS (11).—♀ c (7):

Heliantheæ: *Actineomeris alternifolia*, *Bidens aristosa*, *Helianthus divaricatus*, *H. tuberosus*, *Heliopsis helianthoides*, *Rudbeckia laciniata*, *R. triloba*.

♀ s (2): *Heliantheæ*: *Coreopsis tripteris*, *type* Aug. 24, *Helianthus strumosus*.

♂ s (7:2): *Astereæ*: *Solidago canadensis*; *Heliantheæ*: *Coreopsis tripteris*, *type* Aug. 24, *Helianthus divaricatus*, *H. tuberosus*, *Heliopsis helianthoides*, *Rudbeckia laciniata*, *Silphium perfoliatum*.

Stylopized: Aug. 3.

PSEUDOPANURGUS LABROSUS (4).—♀ c (3) : *Heliantheæ*: *Helianthus divaricatus*, *H. tuberosus*, *Rudbeckia triloba*.

♀ s (1) : *Heliantheæ*: *Rudbeckia laciniata*.

♂ s (3) : *Heliantheæ*: *Helianthus divaricatus*, *H. tuberosus*, *Rudbeckia triloba*.

♂ ♀ in copula (1) : *Helianthus tuberosus*, Aug. 14, *type*.
Stylopized: July 3, type of *Crawfordia labrosi* Pierce.

PSEUDOPANURGUS RUDBECKIÆ (6).—♀ c (5) :
Heliantheæ: *Bidens aristosa*, *Rudbeckia hirta*, *R. laciniata*, *R. subtomentosa*, *R. triloba*.

♂ s (6:1) : *Heliantheæ*: *Bidens aristosa*, *Helianthus divaricatus*, *Rudbeckia hirta*, *R. laciniata*, *R. subtomentosa*, *R. triloba*.

♂ ♀ in copula (4) : *Rudbeckia triloba*, Aug. 3, 21, three pairs, *type*.

Stylopized: Aug. 1; 3, ♂ of copulating pair; 29, type of *Crawfordia rudbeckiæ* Pierce.

PSEUDOPANURGUS RUGOSUS (7).—♀ c (5) : *Heliantheæ*: *Bidens aristosa*, *Helianthus divaricatus*, *H. mollis*, *H. tuberosus*, *type* Aug. 22, *Rudbeckia triloba*.

♀ s (1) : *Heliantheæ*: *Silphium perfoliatum*.

♂ s (6:1) : *Heliantheæ*: *Helianthus divaricatus*, *H. mollis*, *H. tuberosus*, *type* Aug. 22, *Heliopsis helianthoides*, *Rudbeckia triloba*, *Silphium perfoliatum*.

PSEUDOPANURGUS SOLIDAGINIS (7).—♀ c (4) :
Astereæ: *Boltonia asteroides*, *Solidago canadensis*, *type* Sept. 18;
Heliantheæ: *Helianthus grosseserratus*, *Rudbeckia subtomentosa*.

♂ s (6:3) : *Astereæ*: *Solidago canadensis*; *Heliantheæ*: *Bidens aristosa*, *Coreopsis tripteris*, *Helianthus grosseserratus*, *H. tuberosus*, *type* Aug. 22, *Rudbeckia subtomentosa*.

Stylopized: Aug. 11, 12.

VERBENAPIS VERBENÆ (3).—♀ c (3) : *Verbenaceæ*: *Verbena hastata*, *V. stricta*, *V. urticifolia*. The concealed

pollen is drawn from the narrow tubes by inserting the front tarsi with their curled spines.

♂ s (3): Verbenaceæ: *Verbena hastata*, *V. stricta*, *V. urticifolia*.

♂ ♀ in copula (4): *Verbena stricta*, July 11, 21; *V. urticifolia*, July 15, 17.

ZAPERDITA MAURA (2).—♀ c (1): Solanaceæ: *Physalis lanceolata*.

♀ s (1) : Solanaceæ: *Physalis virginiana*.

♂ s (2) : Solanaceæ: *Physalis lanceolata*, *P. virginiana*.

PAIRING HABITS.—Both sexes of all of the species were found. Thirty pairs belonging to eight species were taken in copula. The differences are remarkable. Of eight species no pairs were seen together, while of *Calliopsis coloradensis*, which flies only 36 days and visits only five flowers, seven pairs were taken together, forming a majority of the specimens.

VISITS TO FLOWER CLASSES.—The table shows 144 visits to 85 flowers. *Mas* shows 37.6 per cent. of the flowers visited and 45.1 per cent. of the visits. *Red* shows 35.2 per cent. of the flowers visited, while *yellow* shows 49.3 per cent. of the visits. *Calliopsis andreniformis*, with 35.4 per cent. of the total visits, shows 29.4 to *Mas* and 43.1 to *red*. Separating this species the remaining 15 show for *Mas* 51.1 per cent. of the flowers and 53.7 per cent. of the visits, and for *yellow* 53.3 per cent. of the flowers and 67.7 per cent. of the visits. Seven species, *C. coloradensis*-*P. solidaginis*, show 78.4 per cent. of their visits to *Mas* and 90.1 to *yellow*. The last five show 63.8 per cent. under *Mis* and 44.4 under *white*. As a rule the visits of the males do not differ much from those of the females, but in *Calliopsis andreniformis* the male shows 5.8 less in percentage of visits to *Mas*, 11.0 less *red* and 14.9 more to *white*.

TABLE I.

Flowers observed	Non-social		Social			Total 441	Colors		
	Ma 30.1	Mi 24.2	Mas 18.8	Mis 21.5	Pol 5.2		R 30.3	W 38.7	Y 30.8
Anthemurgus passiflorae	..	1	..	..	..	1	..	1	..
Zaperdita maura	..	2	..	..	..	2	..	..	2
Verbenapis verbenae	..	..	2	1	..	3	2	1	..
Calliopsis andreniformis	12	9	15	10	5	51	22	21	8
coloradensis	..	..	3	2	..	5	..	1	4
Pseudopanurgus albatarsis	..	..	8	3	..	11	2	1	8
labrosiformis	..	..	10	1	..	11	..	..	11
labrosus	..	..	4	..	..	4	..	..	4
rudbeckiae	..	..	4	2	..	6	..	..	6
rugosus	..	..	7	..	..	7	..	..	7
solidaginis	..	..	4	3	..	7	..	1	6
asteris	..	..	3	5	..	8	1	2	5
compositarum	..	..	4	8	..	12	2	6	4
Perdita octomaculata	..	..	1	5	1	7	..	4	3
Perditella boltoniae	..	..	..	1	..	1	..	1	..
Heterosarus parvus	2	1	..	4	1	8	2	3	3
Total visits	14	13	65	45	7	144	31	42	71
Flowers visited	15.2	15.2	37.6	25.8	5.8	85	35.2	31.7	32.9
Visits	9.7	9.0	45.1	31.2	4.8	144	21.5	29.1	49.3
Calliopsis andreniformis	23.5	17.6	29.4	19.6	9.8	51	43.1	41.1	15.6
Others: Flowers visited	4.4	8.8	51.1	31.1	4.4	45	20.0	26.6	53.3
Others: Visits	2.1	4.3	53.7	37.6	2.1	93	9.6	22.5	67.7
C. col.—P. sol.	7	..	78.4	21.5	..	51	3.9	5.8	90.1
P. ast.—Heterosarus	5	5.5	2.7	22.2	63.8	5.5	36	13.8	44.4
C. andreniformis ♀	21.4	16.6	33.3	21.4	7.1	42	52.3	33.3	14.2
C. andreniformis ♂	20.6	17.2	27.5	20.6	13.7	29	41.3	48.2	10.3